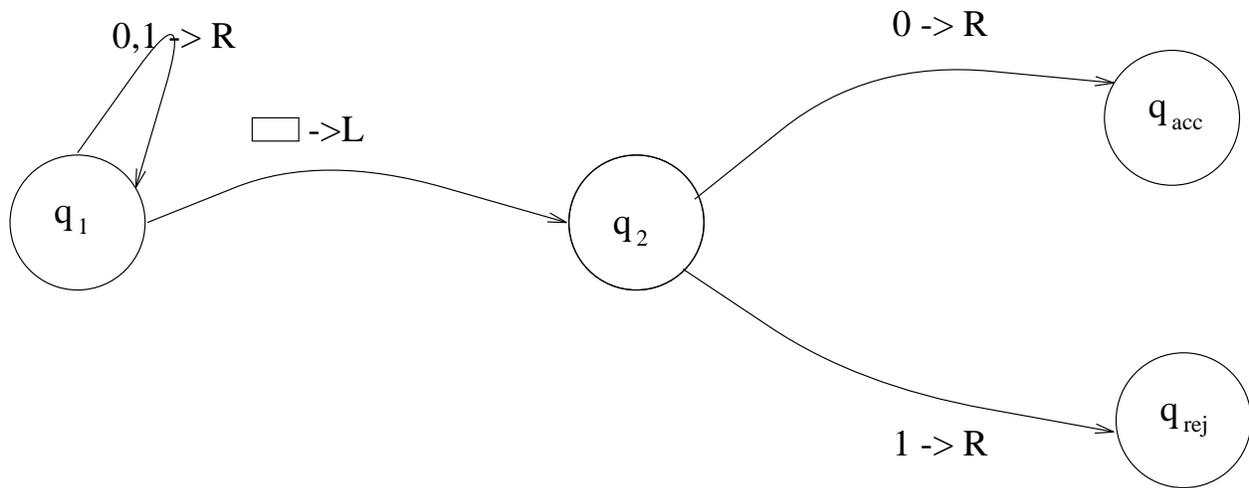


Turing Machine:



RAM program simulating the Turing Machine above:

(Encoding the end of string or empty space in the Turing machine by -1 .)

1. LOAD =1
2. STORE 1
3. READ $\uparrow 1$ (at k th iteration $r_1 = k$ here)
4. STORE 2 ($r_2 := i_k$)
5. LOAD 1
6. ADD =2
7. STORE 1 (at k th iteration $r_1 = k + 2$ here)
8. LOAD 2
9. STORE $\uparrow 1$ ($r_{k+2} := r_2$ (k th input value))
10. ADD 1
11. JZERO 16 (if $r_0 (= r_{k+1}) = -1$ go to 16)
12. LOAD 1
13. SUB 1

14. STORE 1 ($r_1 = k + 1$ here)
15. JUMP 3 (go to 3 for next iteration)
16. LOAD =3
17. STORE 1 ($r_1 := 3$ (the index of register holding the first input))
18. LOAD $\uparrow 1$ (start simulation of $q_1, 0$)
19. SUB =0
20. JZERO 22 (check if symbol is 0)
21. JUMP 26 (if not go to $q_1, 1$)
22. LOAD 1
23. ADD =1
24. STORE 1 (head move to the right)
25. JUMP 18 (transition to start of state q_1)
26. LOAD $\uparrow 1$ (start simulation of $q_1, 1$)
27. SUB =1
28. JZERO 30 (check if symbol is 1)
29. JUMP 34 (if not, go to q_1, \sqcup)
30. LOAD 1
31. ADD =1
32. STORE 1 (head move to the right)
33. JUMP 18 (transition to start of state q_1)
34. LOAD $\uparrow 1$ (start simulation of q_1, \sqcup)
35. SUB =-1
36. JZERO 38 (check if symbol is \sqcup)
37. JUMP 60 (if not, something is wrong; reject)
38. LOAD 1
39. ADD =-1

40. STORE 1 (head move to the left)
41. JUMP 42 (go to $(q_2, 0)$, can be suppressed!)
42. LOAD $\uparrow 1$ (start simulation of $(q_2, 0)$)
43. SUB =0
44. JZERO 46 (check if symbol is zero)
45. JUMP 50 (if not go to $(q_2, 1)$)
46. LOAD 1
47. ADD =1
48. STORE 1 (move head to right)
49. JUMP 58 (transition to q accept)
50. LOAD $\uparrow 1$ (start simulation $(q_2, 1)$)
51. SUB =1
52. JZERO 54 (check if symbol is 1)
53. JUMP 60 (if not, something wrong! reject)
54. LOAD 1
55. ADD =1
56. STORE 1 (move head to the right)
57. JUMP 60 (transition to q reject)
58. LOAD =1 (start simulation of q accept)
59. HALT ($r_0 = 1$)
60. LOAD =0 (start simulation of q reject)
61. HALT ($r_0 = 0$)